

# A BLISTER STRIP FOR AN INHALER

The present invention relates to a blister strip, and more particularly to a blister strip for use in a fluid or powder inhaler.

5 Blister strips are generally used for containing a substance, in particular a pharmaceutical substance, in predosed manner in a dispenser device, such as an inhaler. Each blister thus forms a reservoir containing an individual dose that is sealed in leaktight manner  
10 before use. The device includes drive means which, each time they are actuated, bring a blister into a position that enables it to be opened, thereby releasing the dose of substance contained therein, with said dose then being dispensed to the user. Blister strips of that type  
15 generally include a layer of cavities containing the substance, and a tearable or peelable layer that is fastened on the cavity layer, and that enables each blister to be opened successively. Several problems can occur with that type of blister strip. Thus, in order  
20 ensure that the entire dose of substance contained in the blister is dispensed, the entire surface of the blister must be opened, without presenting burrs or leaving residual portions of the torn layer remaining fastened to the blister, which are likely to retain some of the  
25 substance. In order to resolve that problem, strips that are opened by peeling present an advantage compared to strips that are torn. However, another problem can occur, in particular when the blister strip is used in an inhaler. Each time the inhaler is actuated, only one  
30 blister must be opened in order to avoid any risk of overdosing. In particular with strips that are opened by peeling, it can be difficult to guarantee that only one blister is opened each time the inhaler is actuated, and rather complex means must generally be implemented in  
35 order to ensure that functionality. Another problem that occurs with peelable strips relates to the compromise that must be found between the leaktightness of the

blisters when they are sealed, and an opening capacity that must enable the device to open one blister at each actuation. That compromise is generally rather difficult to achieve, and, with that type of blister strip,  
5 generally prevents opening of the blister being triggered by the user inhaling.

An object of the present invention is to provide a blister strip that does not have the above-mentioned drawbacks.

10 More particularly, an object of the present invention is to provide a blister strip that guarantees that the substance contained in the blister is completely sealed before the blister is opened.

In addition, an object of the present invention is  
15 to provide a blister strip that ensures that each strip is opened completely, guaranteeing that the entire dose contained in each blister is dispensed.

Another object of the present invention is to provide a blister strip that avoids any risk of  
20 overdosing.

Another object of the present invention is to provide a blister strip that can be used in an inhaler, with an opening system that is triggered by the user inhaling.

25 Another object of the present invention is to provide a blister strip that is simple and inexpensive to manufacture and to assemble.

The present invention thus provides a blister strip for use in a fluid or powder inhaler, and including a  
30 plurality of blisters, each formed by a reservoir including an opening that is sealed in leaktight manner by a tearable layer, the blister strip being characterized in that it comprises at least a base layer that is provided with openings forming the openings of  
35 the blisters, and a cavity layer that is provided with cavities forming the blister walls, said tearable layer comprising a first tearable-layer portion that is

disposed between said base layer and said cavity layer,  
and a second tearable-layer portion that is disposed on  
the opposite side of said base layer, said first and  
second tearable-layer portions being connected together  
5 at each opening of the base portion.

Advantageously, the first and second tearable-layer  
portions are made from the same material, advantageously  
from polyethylene, preferably in the form of a continuous  
film of polyethylene having thickness that is less than  
10 100 micrometers ( $\mu\text{m}$ ), advantageously lying in the range  
10  $\mu\text{m}$  to 40  $\mu\text{m}$ , and preferably equal to 30  $\mu\text{m}$ .

Advantageously, said first and second tearable-layer  
portions are connected together as a single part in each  
opening of the base layer, preferably by fusing material.

15 The base layer advantageously comprises polyester,  
and is preferably made in the form of a film having  
thickness that is less than 100  $\mu\text{m}$ , advantageously lying  
in the range 40  $\mu\text{m}$  to 60  $\mu\text{m}$ , and preferably equal to  
50  $\mu\text{m}$ .

20 Advantageously, said cavity layer comprises  
polyethylene and/or polypropylene.

Advantageously, the tearable layer further includes  
a first aluminum layer that is fastened to said second  
tearable-layer portion, possibly by interposing a  
25 polyester layer and an adhesive layer, the aluminum layer  
having thickness that is less than 50  $\mu\text{m}$ , advantageously  
lying in the range 10  $\mu\text{m}$  to 30  $\mu\text{m}$ , and preferably equal  
to 20  $\mu\text{m}$ .

A first outer layer, preferably formed by a  
30 printers' varnish, may also be provided on the tearable  
layer.

Advantageously, the cavity layer includes a second  
aluminum layer, possibly interposed with a polyester  
layer and an adhesive layer.

35 Advantageously, said cavity layer includes a second  
outer layer, preferably formed by a protective layer or

by a layer of varnish, preferably interposed with an adhesive layer.

Advantageously, the adherence of the tearable layer to the base layer between the openings is different from  
5 the adherence in the proximity of said openings.

Advantageously, the blisters contain a pharmaceutical powder.

The present invention also provides a dry-powder inhaler including a blister strip as described above.

10 Other characteristics and advantages of the present invention appear more clearly from the following detailed description, given by way of non-limiting example, and with reference to the accompanying drawings, and in which:

15 • Figure 1 is an exploded diagrammatic view of the structure of a blister strip constituting an advantageous embodiment of the present invention; and

• Figure 2 is a diagrammatic perspective view of a blister strip, with a blister in the process of being  
20 opened.

The embodiment shown in Figure 1 shows a blister-strip structure comprising thirteen different layers. However, it should be understood that some of the layers are optional, as explained in greater detail below.

25 The blister strips 20 of the invention include a plurality of blisters each formed by a reservoir 21 including an opening 25. The blister strip 20 comprises at least a base layer 6 that is provided with openings 25 forming the openings of the blisters. A cavity layer 8  
30 is provided, said cavity layer being provided with cavities 21 forming the walls of the blisters. Finally, a tearable layer is provided for sealing each blister in leaktight manner, said tearable layer being torn open when the user wishes to dispense the dose of substance  
35 contained in the blister. The substance is preferably a dry powder, in particular a pharmaceutical powder.

In the invention, the tearable layer includes a first tearable-layer portion 7 that is disposed between said base layer 6 and said cavity layer 8. In addition, the tearable layer includes a second tearable-layer portion 5 that is disposed on the opposite side of said base layer 6. At each opening 25 of the base layer 6, said first and second tearable-layer portions 7, 5 are connected together. This connection is preferably made as a single part, advantageously by fusing material, and it is thus preferable to make the first and second tearable-layer portions from the same material. The tearable layer can advantageously comprise polyethylene. Each of the first and second tearable-layer portions 7, 5 are advantageously constituted by a continuous film, in particular a polyethylene film, e.g. an extruded polyethylene film, that is applied to the base layer, and that has a thickness that can be less than 100  $\mu\text{m}$ , advantageously lying in the range 10  $\mu\text{m}$  to 40  $\mu\text{m}$ , and preferably equal to 30  $\mu\text{m}$ . As shown diagrammatically in Figure 1, during this application, fusion of material takes place between the first and second tearable-layer portions at openings 25 of the base layer 6, guaranteeing that the contents of the blisters 21 are completely sealed in the closed position. The base layer 6 advantageously comprises polyester, and can have a thickness that is less than 100  $\mu\text{m}$ , advantageously lying in the range 40  $\mu\text{m}$  to 60  $\mu\text{m}$ , and preferably equal to 50  $\mu\text{m}$ . In addition, the cavity layer 8 can include polyethylene and/or polypropylene, and can be a little more rigid so to make it possible to form the cavities 21 forming the blisters.

As shown in Figure 1, various optional layers can be provided in the multilayer structure of the blister strip 20 of the invention. Thus, the tearable layer can further include a first aluminum layer 2 of thickness that is less than 50  $\mu\text{m}$ , advantageously lying in the range 10  $\mu\text{m}$  to 30  $\mu\text{m}$ , and preferably equal to 20  $\mu\text{m}$ , and

that is intended mainly to protect the contents of the blister against moisture. The aluminum sheet 2 is advantageously fastened to the tearable layer, in particular to the second tearable-layer portion 5, with a polyester film and an adhesive layer interposed therebetween. Naturally, it is possible to envisage other fastener means for fastening the aluminum layer 2 to the tearable layer 7, 5. The polyester layer 4 can be made in the form of a film having a thickness that is less than 50  $\mu\text{m}$ , advantageously lying in the range 10  $\mu\text{m}$  to 15  $\mu\text{m}$ , and preferably 12  $\mu\text{m}$ , and the adhesive can be any suitable glue. Advantageously, a first outer layer 1 is provided that can advantageously be formed by a printers' varnish, making it easier to print an inscription on the tearable layer. In addition, the cavity layer 8 can also include a second aluminum layer 11, also intended mainly to protect against moisture. In similar manner, said second aluminum layer 11 can be fastened to the cavity layer 8 with a polyester layer 9 and a suitable adhesive layer 10 interposed therebetween. In addition, a second outer layer 13 can be provided on the side including the cavity layer 8, and is preferably formed by a protective layer or by a layer of varnish, and said second outer layer 13 can be fastened by means of an adhesive layer 12. Interposing the polyester layers 4 and 9 can make it easier to fasten the aluminum layers 2 and 11 on each side of the blister strip 20.

With reference to Figure 2, that shows a process of opening a blister strip 20 as described above, it should be observed that, after assembly, the multilayer structure is in fact formed of only two separable portions, a cavity portion constituted by layers 6 to 13 described in Figure 1, and a tear-off-strip portion A constituted by layers 1 to 5 described in Figure 1. Naturally, as explained above, the multilayer structure can be made in a way that is different to the way described with reference to the Figure 1 embodiment.

In operation, when a blister 21 of the blister strip 20 needs to be opened, traction on the strip A portion has the effect of lifting said strip A off the cavity portion B. When an opening 25 is reached, the edge of each opening 25 of the base layer 6 tears the material connection formed between the first and second tearable-layer portions 7, 5 so that a disc C of the first tearable-layer portion 7 remains fastened to the second tearable-layer portion 5, and therefore to the tear-off strip A, thereby opening the cavity of the blister 21 so as to release the content of said blister. The presence of a tearable-layer portion on each side of the base strip 6 guarantees that the blister 25 is opened in clean and accurate manner, and in particular avoids the presence of any burrs or residual portions of the tearable layer on the edges of the opening, which would risk retaining some of the substance contained in the blister cavity. Dispensing the entire dose is therefore guaranteed with the blister strip of the invention. In addition, the blister strip of the invention is particularly adapted to be used in an inhaler, in particular of the type including a blister opening system that is actuated by inhalation. The present invention makes it possible to provide the tearable layer 7, 5 with an adherence to the base layer 6, between the openings 25, that can be different, in particular that adheres less well than the tearable layer 7, 5 to the base layer 6 in the proximity of, or at, said openings 7. The opening force for each dose can therefore be adapted in optimum manner, while guaranteeing complete sealing by means of the material connection between the two tearable-layer portions. As a result, it is possible to make a blister strip that can be opened easily and safely by means of a system that is triggered by the user inhaling.

The materials described with reference to the structure shown in Figure 1 could also be modified, in

particular using materials that are similar or that have suitable properties. In particular, the base layer, the cavity layer, and the tearable layer could be made from any material that is suitable for this purpose, e.g. from the polyolefin family. In addition, the thicknesses are given by way of indication, and could be provided in various ways. In addition, the various layers could also be assembled relative to one another in any suitable manner.

10           Other modifications could also be envisaged by a person skilled in the art, without going beyond the ambit of the present invention, as defined by the accompanying claims.